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ABSTRACT

The task force report examines the use of adaptive devices by severely handicapped students. Interviews with teachers and therapists produced information on the selection, development, and use of the devices. Four practices that positively influenced the devices' use were identified: (1) design and construction following establishment of appropriate curricular content; (2) design and construction based upon consideration of at least 11 dimensions, including cost-benefit ratio, time required, and safety; (3) use in conjunction with meaningful instruction; and (4) systematic evaluation of adaptive devices. Adaptive devices which compensate for physical and intellectual performance deficits are explained and illustrated. Examples include a switch box designed to teach students to control a variety of electrical items in the environment and picture recipe cards to teach students to cook. A final section addresses eight phases in selecting and adapting adaptive devices. Stages include identification of performance discrepancies between nonhandicapped and severely handicapped students and determination of possible and improbable skills. Case studies illustrate the process. (CL)

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UTILIZING ADAPTIVE DEVICES WITH SEVERELY HANDICAPPED STUDENTS[1]

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I. INTRODUCTION

Many severely handicapped[3] students receive instruction designed to prepare them for functioning in a wide variety of heterogeneous post-school environments. Some, because of physical or intellectual deficits, require personal supervision and/or adaptive devices[4] to function acceptably (Baumgart et al., 1980). Whereas at one point in time adaptive devices were viewed as cumbersome, costly, and appropriate for only the most severely multihandicapped students, this view is changing. Federal and state research monies have promoted extensive examination of adaptive devices to help meet the needs of severely handicapped students. As a result, a wide variety of devices are now available. Furthermore, increasing efficiency, decreasing cost, and smaller microelectronic devices have made them more reasonable options for use by severely handicapped students. Such adaptive devices are enabling large numbers of severely handicapped students to access environments and activities from which they were formerly excluded. Consequently, students are able to exert control over their environments by learning to perform meaningful skills previously thought impossible.

A. Purpose

Students from the University of Wisconsin-Madison and teachers and therapists from the Madison Metropolitan School District formed a task force to examine the current use of adaptive devices by severely handicapped students. More specifically, the purposes were to:

1. Identify practices which influence the effective use of adaptive devices;

2. Investigate rationales and strategies for selecting and utilizing adaptive devices with students who have physical and intellectual performance deficits; and

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[3]The label "severely handicapped" refers to approximately the lowest intellectually functioning 1% of the school age population. This 1% range includes students who also have been ascribed such labels as psychotic, autistic, moderately/severely/profoundly retarded, trainable level retarded, physically handicapped, multiply handicapped, and deaf/blind. Certainly, a student can be ascribed one or more of the labels delineated immediately above and still not be referred to as severely handicapped for purposes here, as he/she may not be currently functioning intellectually within the lowest 1% of a particular age (Brown et al., 1982).

[4]Adaptive devices as the term is used here refers to portable objects, equipment, or materials created for instructional purposes that enhance or allow at least partial participation in a specific activity. Portable switches, collating boxes, mouth sticks, communication books, are a few examples (Baumgart et al., 1980).

3. Provide examples of, and construction plans for, adaptive devices currently used in vocational, domestic, recreation-leisure and community environments.

These activities were undertaken in order to provide teachers and therapists with strategies to develop individualized adaptive devices that could maximize the educational and postschool functioning of severely handicapped students.

B. Collection of Information

Task force members interviewed teachers and therapists of severely handicapped students regarding the adaptive devices being used in educational programs. The following information was collected:

1. The name and description of the device;
2. The name, diagnosis, and general description of the student for whom the device was designed;
3. The school and/or nonschool environment(s) in which the device was used;
4. The activity(ies) during which the device was used;
5. The specific skill deficit(s) for which the device was designed to compensate;
6. The purpose(s) for using the device;
7. The frequency of use;
8. The number of students who used the device;
9. The advantages and disadvantages of using the device;
10. The plan for the construction of the device (if available);
11. The amount of time required to construct the device; and
12. The approximate price of the materials needed.

In the process of collecting this information, four general practices were noted which positively influence the effective use of adaptive devices by severely handicapped students. These include the use of adaptive devices which are: designed and constructed after curricular content has been prioritized; designed and constructed in consideration of at least 11 dimensions; used in conjunction with meaningful instruction; and systematically evaluated. The following section addresses each of these practices separately.

II. PRACTICES WHICH INFLUENCE THE EFFECTIVE USE OF ADAPTIVE DEVICES WITH SEVERELY HANDICAPPED STUDENTS

A. The Design and Construction of Adaptive Devices After Curricular Content Has Been Established

Prior to using an adaptive device, an individualized education program should be established. That is, the performance deficits assessed in a particular environment while a student is engaged in individually relevant activities should be analyzed to determine the skill deficits for which adaptive devices might be needed, rather than letting the availability of an adaptive device dictate the curricular content to which the student is exposed. Unfortunately, the proliferation of manuals that describe how adaptive devices are constructed typically contain few, if any, guidelines for interfacing their use with relevant curricular content. Too often, a device is constructed without considering the contexts in which it will be used. As a result, the potential for teaching nonfunctional or otherwise inappropriate skills is increased. For example, teaching a severely handicapped student to utilize a device that will enable him/her to kick, pull rings, turn on disco lights, etc., when these actions do not enable at least partial participation in meaningful activities is not educationally defensible. Individualized adaptive devices that are selected and designed after the establishment of appropriate curricular content will lead to the acquisition of more relevant skills.

B. The Design and Construction of Adaptive Devices in Consideration of At Least 11 Dimensions

Educational and related services personnel are designing and constructing adaptive devices for severely handicapped students. These devices must be carefully designed to ensure their maximal, efficient, and functional use. A major contribution to the generation of a decision process was made by Baumgart et al. (1930) who offered 11 dimensions to consider before designing an adaptive device. They suggested that decisions about adaptive devices be made in consideration of:

1. The number of environments in which the device will be utilized;
2. The number of activities for which the device will be utilized;
3. The cost-benefit ratio, i.e., the amount of money required in proportion to the effects that will accrue;
4. The time required to use the device;
5. The number of habilitative interactions with nonhandicapped peers and other persons that can be realized through the use of the device;

6. The safety of the device;

7. The enjoyment and comfort that is realized by the student through the use of the device;

8. The maintenance requirements of the device;

9. The amount of training that will be necessary to teach the student how to effectively use the device;

10. The chronological age appropriateness of the device; and

11. The social significance of the device, i.e., the effect it has on the acceptance, respect, pride, etc., afforded a handicapped student by others.

Additionally, the learning and performance characteristics of a severely handicapped student should be considered. For example, a student's rate of skill acquisition often provides valuable information as to the probability that a skill will be acquired within a reasonable amount of time without the use of an adaptive device. Therefore, based on previous skill acquisition data, instead of developing a picture sequence booklet to assist a student to make a meal, a teacher might decide to teach the student to make it from memory.

C. The Use of Adaptive Devices in Conjunction With Meaningful Instruction

The use of an adaptive device must be taught. That is, an adaptive device should not serve as a substitute for, or be used in the absence of, meaningful instruction. The mere provision of a device does not guarantee that the student will be able to use it effectively. Objections have been raised when a device has replaced human contact and relevant instruction, rather than being used to enable a student to engage in a meaningful sequence of skills (Campbell, Bricker & Esposito, 1980). Certainly, responsible instructional procedures related to the use of adaptive devices can eliminate this problem. For example, a device such as a switch box can enable a student to activate a tape player thereby allowing her to participate in a recreation/leisure activity. Also, a coin card designed to allow coins to be matched to pictoral representations of quarters, dimes, and nickels can assist a student to use a vending machine without assistance. These devices were designed, constructed and provided to students in conjunction with meaningful instruction, and students subsequently learned to use them in order to participate in relevant environments and activities.

D. The Systematic Evaluation of Adaptive Devices

After an adaptive device has been utilized by a student, it should be evaluated systematically to assure ongoing effectiveness.

Teachers might ask the following questions to evaluate adaptive devices.

Can use of the adaptive device be faded or eliminated?

If the answer to this question is yes, then the teacher should teach the student to perform the skills for which the adaptation was to compensate and systematically introduce a form of the adaptation that accounts for those skills that have been acquired. Figure 1 illustrates four phases in the fading of an adaptive device designed to assist a student in gathering the materials necessary to complete a hotel housekeeping sequence. The initial phase included large print and drawings listing the individual items needed to complete the job. In later phases, as the student learned to read key words, the size of the print and drawings was decreased, or faded. In Phase IV, the device consisted only of a list of words which cued individual steps within the skill sequence. This student might always require external cues of this nature in order to perform this task, however, for another student an adaptive device of this nature may be unnecessary or completely faded.

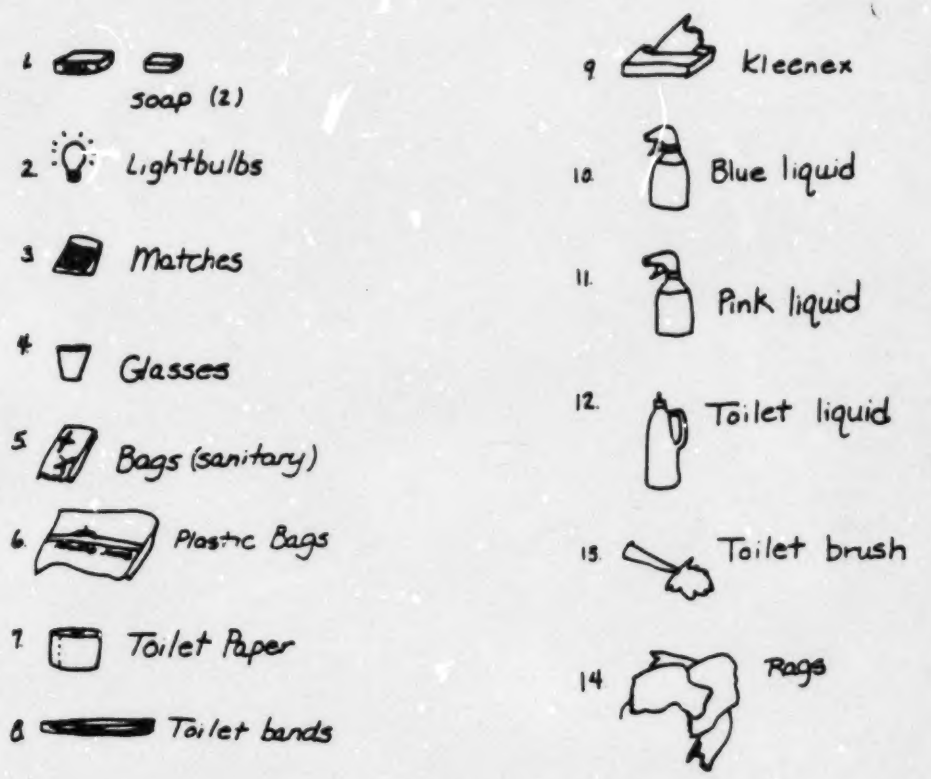
If the answer to this question is no, the teacher should arrange for the student to have access to the adaptive device in every naturally occurring situation in which it is required. The teacher might also teach the student to use an alternate strategy in the event that the adaptive device is not available. For example, assume a student needs liquid soap rather than bar soap in order to independently wash her hands. In the event that the liquid soap container is either empty or missing, her teacher might teach her to ask for assistance.

Does the use of the adaptive device result in an acceptable rate and quality of performance?

If the answer to this question is no, the teacher must determine if the performance discrepancies are a result of the adaptive device, the instructional arrangement, or student characteristics such as boredom with or distraction from the task. After the reasons for the performance discrepancies have been determined, actions must be taken to alleviate or minimize them.

Is the adaptive device being used to the greatest extent possible across activities?

If the answer to this question is no, the teacher should take steps to incorporate the use of the adaptive device or similar devices into appropriate activities. For example, a student with very limited use of her arms who successfully learned to pull on a string attached to her wrist in order to throw dice to play yahtzee might be able to pour liquid into glasses, dump ingredients into a mixing bowl, drop clothes into a hamper, etc., using a similar device.



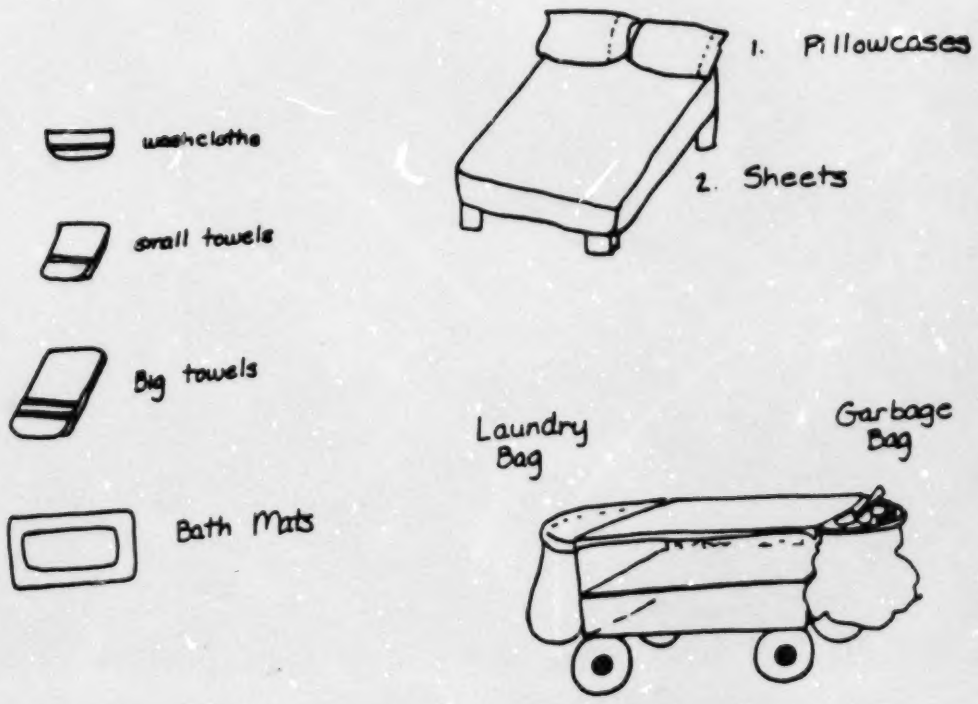


Figure 1, Phase 1. An adaptive device to assist in gathering materials necessary to complete a housekeeping sequence. (Designed by Alice Udvari)

Figure 1, Phase II. An adaptive device to assist in gathering materials necessary to complete a housekeeping sequence. (Designed by Alice Udvari)

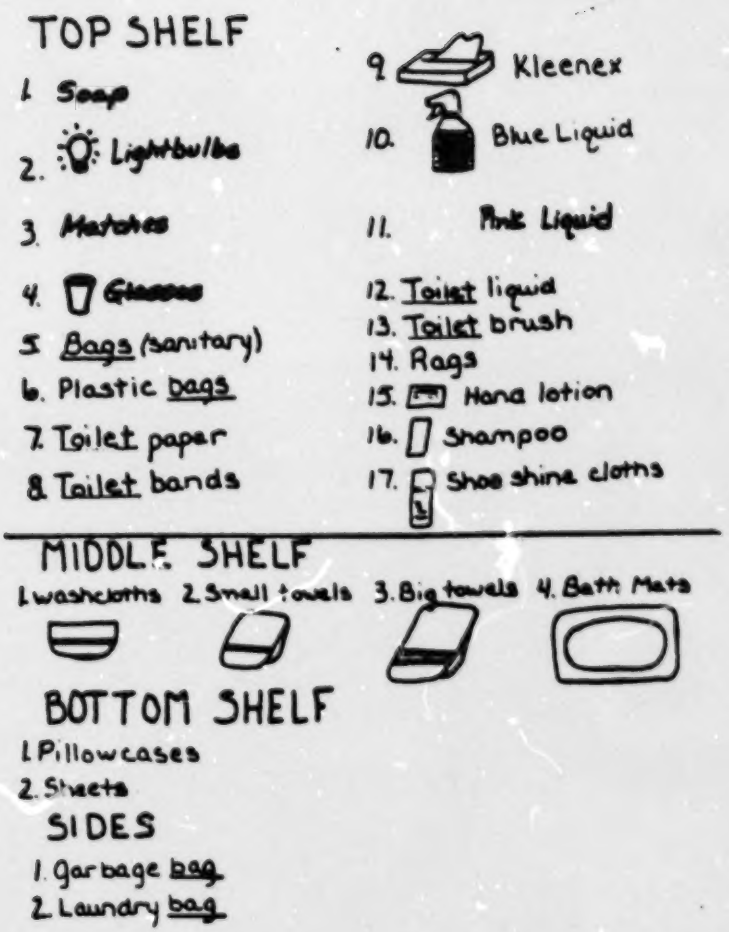


Figure 1, Phase III. An adaptive device to assist in gathering materials necessary to complete a housekeeping sequence. (Designed by Alice Udvai)

Figure 1, Phase IV. An adaptive device to assist in gathering materials necessary to complete a housekeeping sequence. (Designed by Alice Udvari)

III. ADAPTIVE DEVICES WHICH COMPENSATE FOR SPECIFIC PERFORMANCE DEFICITS

Typically the rationales offered for the creation of adaptive devices stem from two major deficits, physical and intellectual. These deficits typically interfere with the performance of a response at an acceptable rate, duration and/or level of quality.

A. Adaptive Devices Which Compensate for Physical Deficits

An adaptive device designed to compensate for a physical disability is used when a severely handicapped student has a sensory or motoric deficit such that he/she is unable to make a needed response. For example, a student who is only able to turn her head from side to side may require an electronic head switch to communicate a yes (to the right) or no (to the left) response. The nature of this device is different from one which is required by a student whose handicapping condition is primarily intellectual; that is, a student who is unable to perform an activity because of attention, memory, or academic abilities but is not motorically disabled. In this situation, a student may have the motoric abilities to make a needed response but not be able to sequence the steps of the activity. For example, Wayne is unable to launder his clothes because he performs the required steps out of sequence. Thus, a book containing sequenced pictures of "doing laundry" is used to cue him to perform this activity correctly. Certainly, devices intended to compensate for intellectual and physical deficits are not mutually exclusive and can be used synergically. The following discussion provides descriptions and illustrations of devices that have been used with severely handicapped students with physical deficits.

A number of articles have described how to design and use a variety of adaptive devices to maximize the performance of self help skills. Barnes, Murphy, Waldo, and Sailor (1979) described the modification of mealtime utensils to facilitate grasping and hand to mouth patterns, and clothing aids that enable a student to dress independently. Campbell, Green, and Carlson (1977) discussed positioning and mobility devices that enable a student to actively reach for an object or to move from one environment to another. Other devices of a similar nature were reported by Lowran and Kleiger (1969) and Robinault (1973).

Vanderheiden (1978) described a variety of head sticks and other head gear which enable a student to interact and communicate more effectively through direct selection or pointing to symbols; and a few devices which enable a student to either type or write. Other devices that might be appropriate for use with a severely handicapped student include: an "Attention Getter",[5] a "Beep Box",[6] and a "Hey You."[7] Each of these allow a nonverbal student to solicit

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[5] Simple signaling aid with a short beep of preset duration

[6] Simple beep signaling device with a latching light

[7] Activating switch which triggers a sound for two seconds

the attention of another individual.

An example of a teacher made adaptive device created to compensate for a communication deficit is presented in Figure 2. This device is an 8 x 11 inch binder with metal rings attached to enable a nonverbal student with poor fine motor skills to open the binder and turn to the appropriate page of symbols needed for communication purposes. A less complex communication device is presented in Figure 3. This was created to enable a nonverbal severely multihandicapped student to order at a fast food restaurant. A picture of the desired food item was preselected by the student and inserted into a clear plastic holder mounted on top of a polypropylene board. The student then grasped the wood dowel at the top of the device and presented it with his selection to a food service employee. The message on the board was applied with a grease pencil which can be easily erased.

A type of adaptive device recently considered for use with severely handicapped students involves the use of "biofeedback." Several investigations have utilized this technique and demonstrated the effectiveness of response contingent reinforcement in improving the motoric performance of multihandicapped individuals (Grove, Dalke, Fredricks & Crowley, 1975; Wether, 1982; Woolridge & McLarvin, 1976; Zuromski, 1977). The majority of this research reported an increase in the frequency and duration of an upright head position as the result of music contingently turned on by electric head-switches which are activated by a student performing the desired head-lifting response. It is important that the movement response, i.e., head-lifting, and the function of the movement response, i.e., exerting control over the environment, are both considered.

The switch box illustrated in Figure 4 is an example of a device developed to teach a student to control a variety of electrical items in her environment. The box is connected by plugs both to an electrical wall socket and the electrical device or appliance of concern. The latter can be activated by pressing the switch on the top of the box. This device was used to teach a student snack preparation skills. In this activity, the student was required to turn on and off a blender for the purpose of making a fruit drink which she would then drink.

Another severely handicapped student was taught a specific clerical task as part of his vocational program. His job at a radio station was to fold letters into thirds and then insert them into envelopes. Because of his motoric and visual deficits, he was unable to fold the letter into exact thirds. Therefore, the adaptive device illustrated in Figure 5 was created. This device has a metal flap in the center designed to allow the student to fold one end of the letter, then the other, toward the center. When both ends were folded over the metal flap, the student slid the letter off the device and inserted it into an envelope.

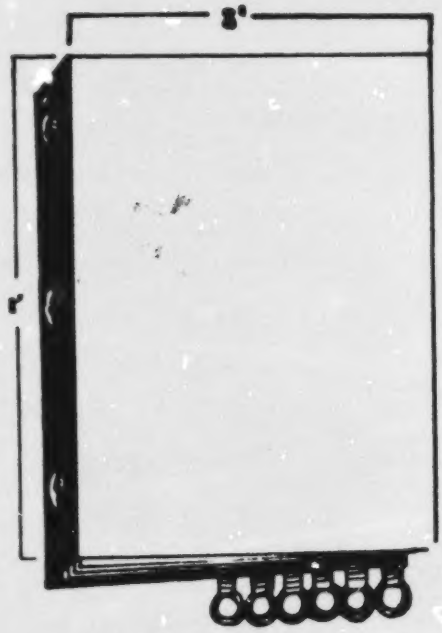


Figure 2. A communication notebook with rings to assist in opening and closing.

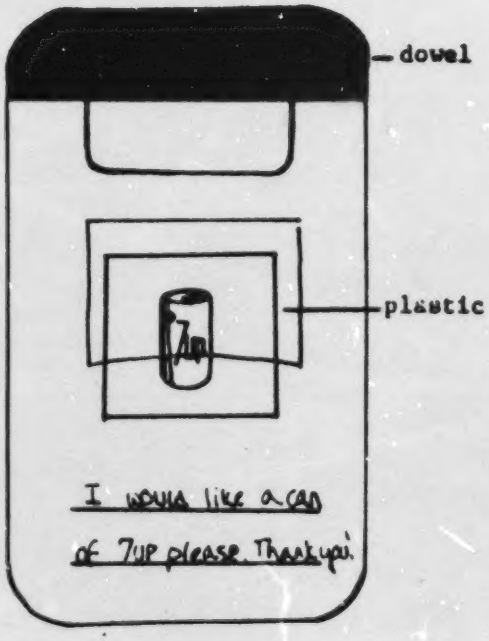


Figure 3. A Communication board to assist in indicating a single coice in the community. (Designed by Kathy Zanella)

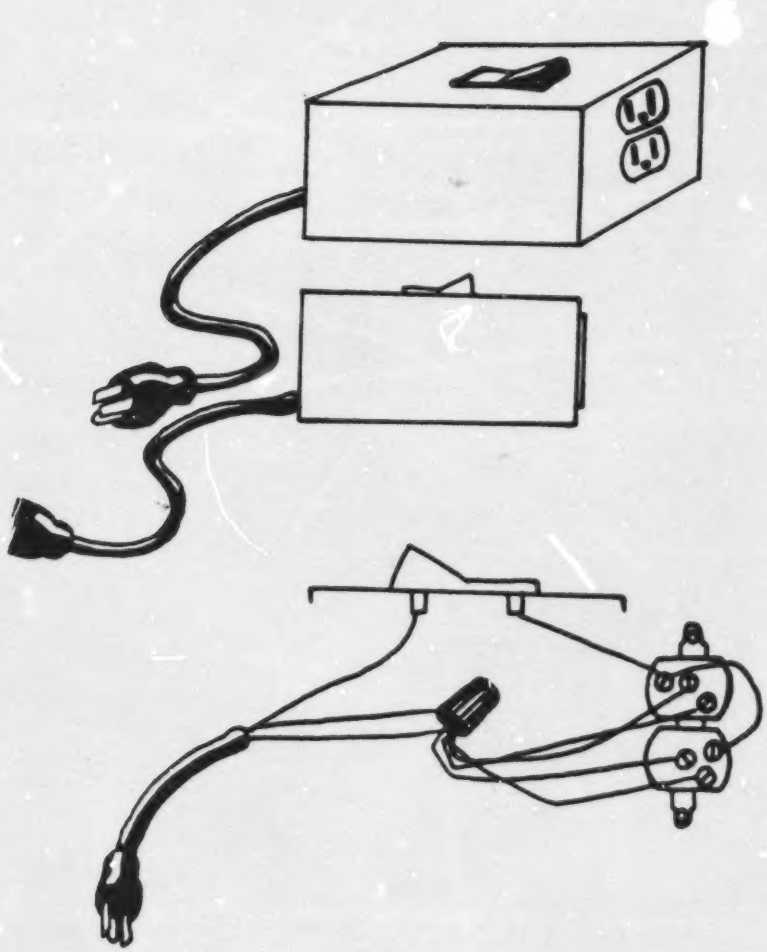


Figure 4. A switch box to assist in turning on an electrical appliance or some other device. (Designed by Lucy Hansen)

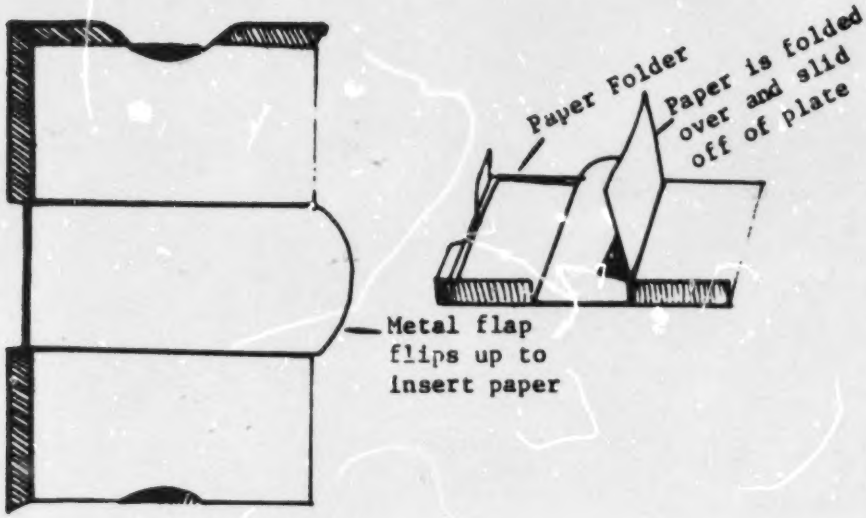


Figure 5. An adaptive device to assist in folding letters. (Designed by Kathy Zanella)

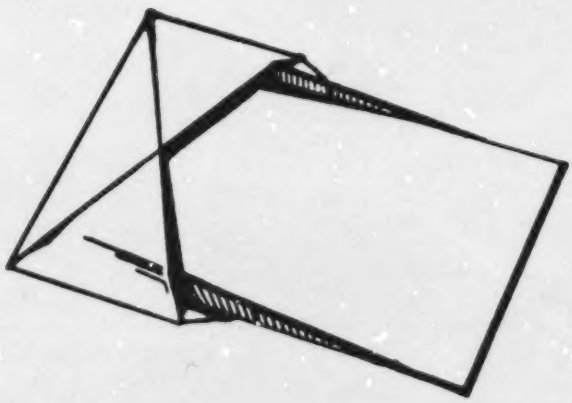


Figure 6. An adaptive device to assist in stuffing envelopes. (Designed by Stacy Graff)

Figure 6 illustrates a simple adaptive device constructed for a student learning to stuff envelopes. She had difficulty inserting the mailings because of poor fine motor skills and therefore performed at a slow rate. A piece of cardboard with the sides bent upward enabled the student to lift the edges of the envelope therefore making insertion easier.

A severely multihandicapped student learning to clean his work area upon completion of his job was unable to maintain a grasp on a sponge or rag. The device illustrated in Figure 7 was made of hard sponge with a rope pulled up through drilled holes and knotted to secure the rope to the sponge. This device enabled the student to maintain a grasp long enough to clean his work surface.

Many of the devices described above relate to the performance of vocational skills. Certainly vocational functioning is an important component of any Individual Education Program. However, when students are not engaged in required tasks, there is time to engage in recreation/leisure activities. Figure 8 depicts an adaptive device created for a 20-year-old student who has hemiplegia which affects the left side of her body, causing difficulty when she has to hold objects with both hands. The device depicted enabled her to engage in embroidery activities by securing the fabric onto a metal stand.

B. Adaptive Devices Which Compensate for Intellectual Deficits

There are many skills typically performed by nonhandicapped persons that cannot be acquired or that are acquired at a relatively slow rate by severely handicapped persons. These performance discrepancies may be related to poor intellectual processing rather than motoric deficits. Wheeler, Ford, Nietupski, Loomis, and Brown (1979) taught seven severely handicapped students to use pocket calculators to make purchases in grocery stores. Students were taught to enter the amount of money they had into their calculators, match numbers on price tags to the keys on the calculator, accurately punch prices into the calculator and successively subtract the prices of items until a minus sign appeared. They were then taught to return the last item to the shelf as a means of assuring that they had enough money to make the purchase. This device was used for severely handicapped students who lacked the necessary addition and/or subtraction skills.

Another example of an effort to compensate for the intellectual deficits of severely handicapped individuals was reported by Robinson-Wilson (1976). The use of picture recipe cards to teach severely retarded adults to cook was described. Though data were not reported, this approach to cooking has been reported as effective by others (Roberts, 1976; Steed, 1974). Figure 9 illustrates an example of an adaptive device created for a student who did not have the necessary memory or sequencing skills to prepare a meal. It was used to teach the student to independently cook frozen waffles. A similar

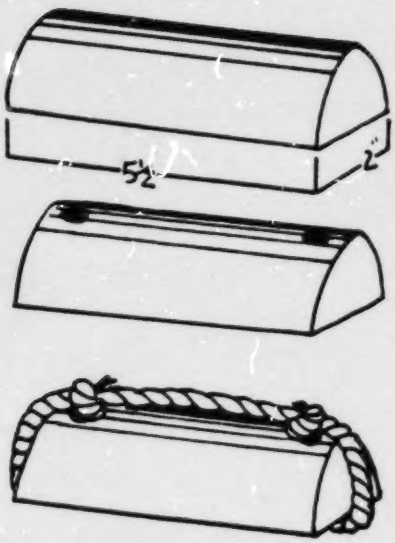


Figure 7. An adaptive device to assist in washing and cleaning.

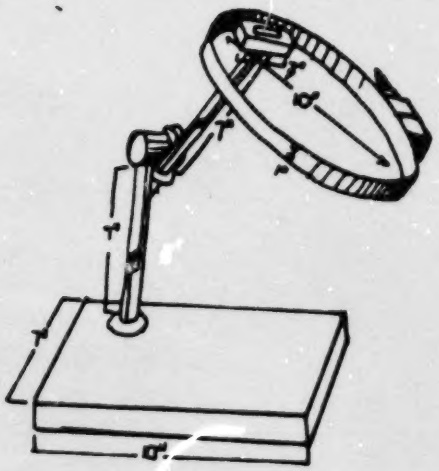
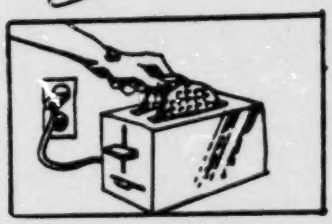


Figure 8. An adaptive device for embroidery.

Materials

Steps

1.



2.

3.

4.

5.

Figure 9. A pictoral sequence of making waffles.

device utilized in a vocational environment to sequence the steps required to clean a bathroom is presented in Figure 10. The sequence of pictures and words cued the student to perform the skills necessary to complete the cleaning sequence. The teacher anticipated that as the student acquired the skills to clean the bathroom, the pictures would be faded. The student, then, would either rely on the words or his memory to complete the sequence.

Figure 11 depicts a device used to complete a housekeeping activity. This device was designed for a student who could perform the skills necessary to clean a hotel room but had difficulty checking the quality of her work. With this device, if the student opened the tab labeled "drawers," there were two photographs depicting the items which should be in the respective drawers. This device reminded her that the hotel menu, a telephone book, a bible, etc. had to be included. Whereas some severely handicapped students are able to perform a six step sequence without external cues, some may require an adaptive device for only a two step sequence. The stacking box illustrated in Figure 12 enables a student to stack one collation in one direction and another in the opposite direction. After the papers are collated and stacked in this fashion, they are either stapled or counted. This device has also been used by a student with a motoric disability. Although the student was able to accurately perform the two step sequence of alternately stacking collations, she required the boxes to keep the pages in neat piles.

Many severely handicapped students require additional information or an instructional cue to perform specific skills within a sequence. This information may be delivered through the use of adaptive devices. For example, a student who packages pills was required to return supplies to a specific shelf. After approximately one month of instruction, the student continued to have difficulty locating the correct shelf without verbal and physical cues. The teacher attached a pill package to the appropriate shelf to cue the student as to where unused supplies should be placed. This reduced the number of verbal and physical cues required.

Certainly, more than one cue may be necessary for a severely handicapped student to complete an activity. For example, at a work site in a physics laboratory a student was required to sort screws, nuts, and washers for recycling purposes. The student had consistent difficulty sorting these objects into the correct piles. The adaptive device illustrated in Figure 13 includes cues to assist the student to discriminate between the piles. A nut, screw, and washer were glued to metal separators. The student was able to move the objects from the circular enclosure to the matched samples.

The previously described adaptive devices are examples of creative ways to increase the participation of severely handicapped students in relevant activities. These devices described above were <u>individualized</u>. Although each may be useful to other students, caution must be exercised to prevent unnecessary use, inappropriate use, or overuse with other students.

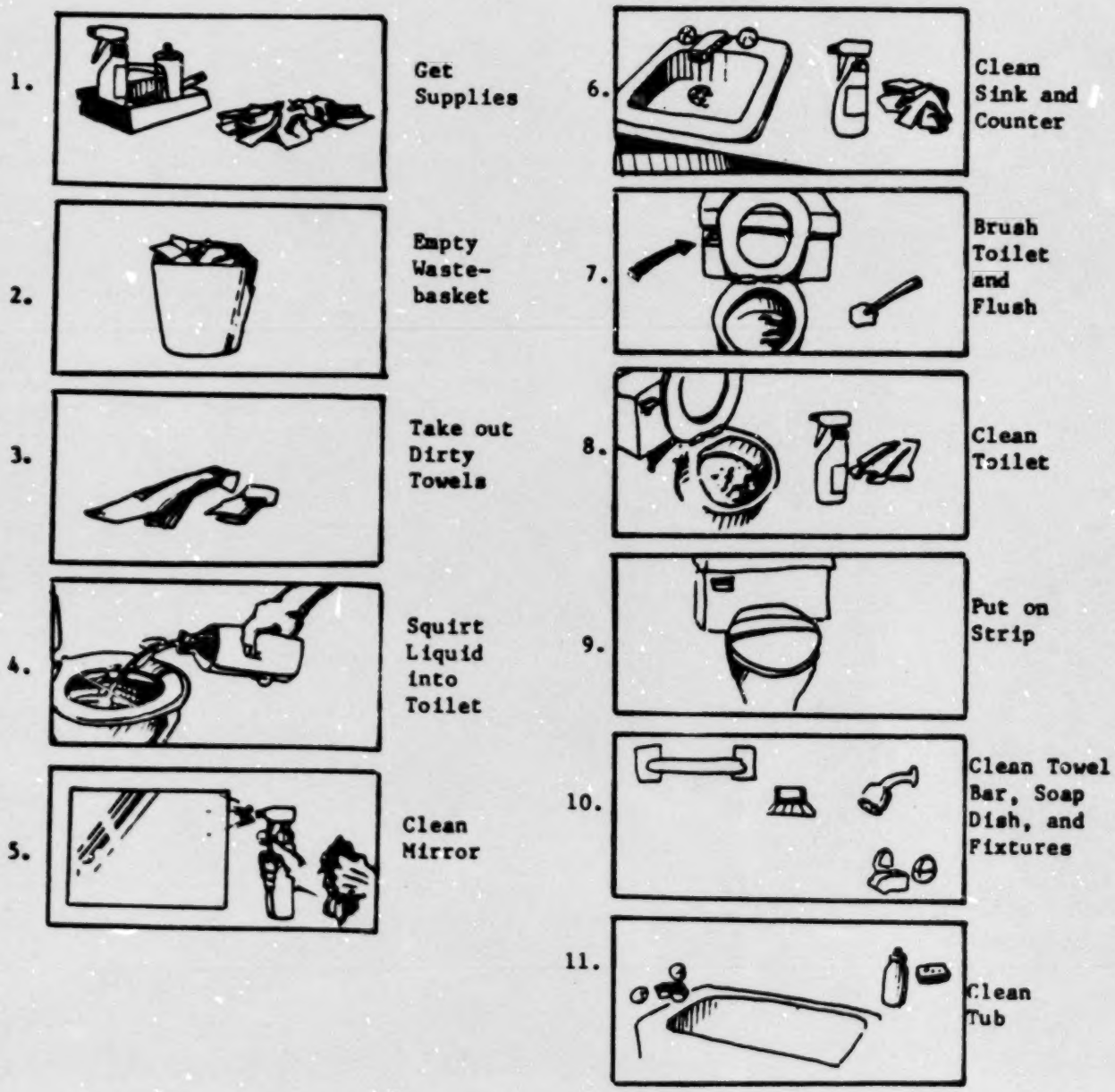
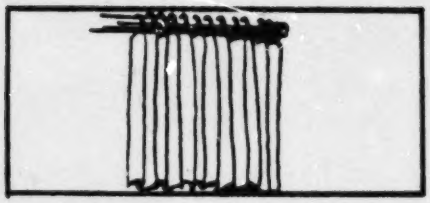


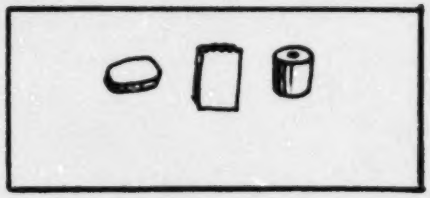
Figure 10. A pictoral sequence of cleaning a bathroom.

12. 

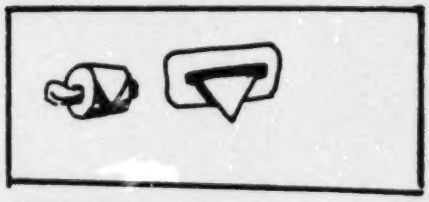
Clean Shower Curtain

13.

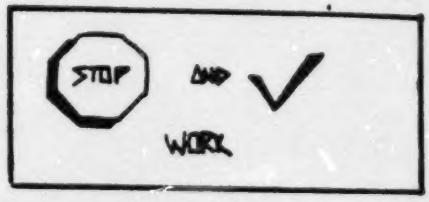
Get Towels; 3 bath towels, 3 hand towels, 3 washcloths, and 1 bathmat

14. 

Get 2 Soaps, 3 sani-bags, 1 toilet paper

15. 

Fold Triangles

16. 

Stop and Check Work

17.

Wash Floor

18.

Return Wastebasket

Figure 10 (Continued). A pictoral sequence of cleaning a bathroom.

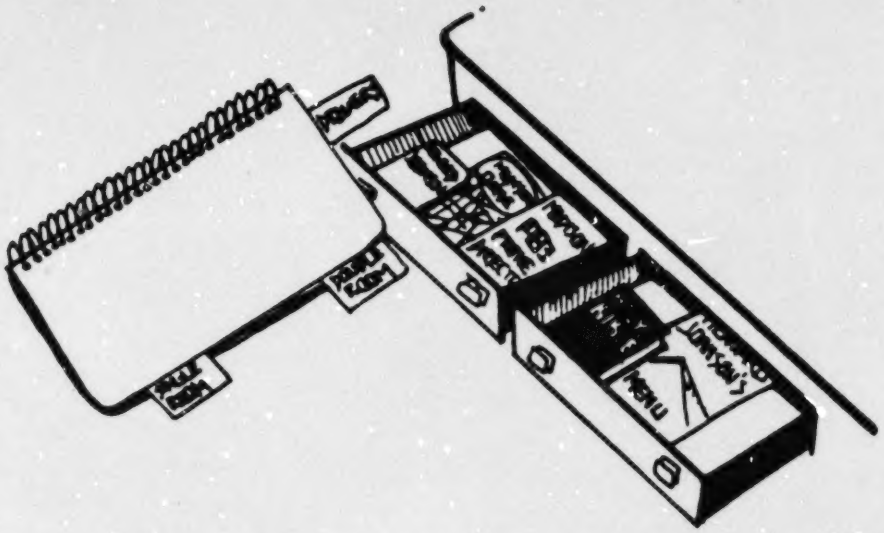
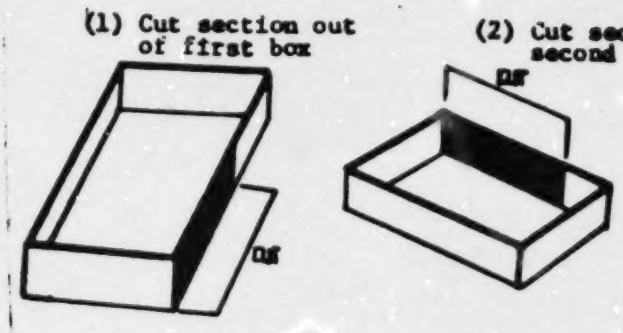


Figure 11. An adaptive device for quality checking a housekeeping job. (Designed by Alice Udvari)



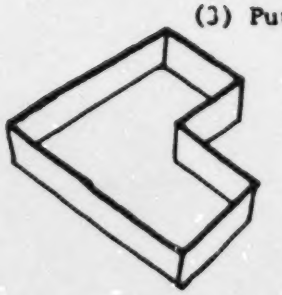


Figure 12. An adaptive device to assist in stacking collations.

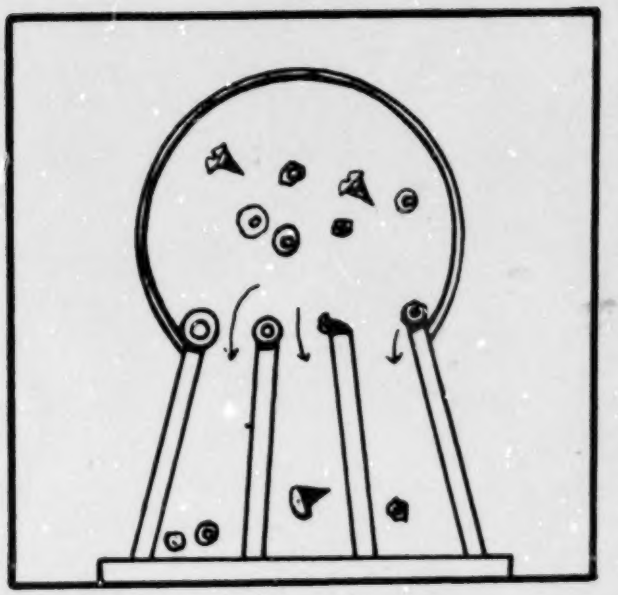


Figure 13. An adaptive device to assist in sorting. (Designed by Sue Richter)

IV. SELECTING AND DEVELOPING ADAPTIVE DEVICES

Baumgart et al. (1980) described an eight-phase strategy that can be used to make decisions regarding the selection and development of adaptive devices. These eight phases are:

1. Perform a Nonhandicapped Person Inventory;
2. Perform a Severely Handicapped Student Inventory;
3. Determine the Skills the Student Can Probably Acquire;
4. Determine the Skills the Student Probably Cannot Acquire;
5. Generate an Adaptation Hypothesis;
6. Conduct an Adaptation Inventory;
7. Decide Upon Individualized Adaptations; and
8. Determine the Skills That Probably Can be Acquired Using Individualized Adaptations (p. 23).

This eight phase process enables educators to compare the performance of a severely handicapped person with that of a nonhandicapped person in order to identify performance discrepancies. Decisions can then be made as to whether: to teach the skill sequence as it is performed by nonhandicapped persons; to modify the sequence; and/or to provide some kind of adaptation.

The following is a case study describing a severely handicapped student and the strategies that were used to select and develop adaptive devices to increase her level of independence in performing her job. Each phase presented by Baumgart et al.(1980), although not specifically outlined here, was considered. Five additional examples describing adaptive devices designed to improve vocational performance are presented in Section B. The strategies used are applicable when developing adaptive devices in other skill areas, i.e., domestic, recreation/leisure, and community functioning.

A. Case Study

Description of Student

Mary is 21 years old with spastic quadriplegia. She uses an electric wheelchair which she controls by moving a joystick with her left hand. She has limited use of her right arm and hand and therefore depends primarily on her left arm for upper extremity functions. Her arm movement is slow and unsteady. Because Mary is nonverbal, she uses an augmentative communication board which is located on the tray of her wheelchair. She is able to directly select symbols on her board to initiate interactions and make responses.

Environment: WHA Radio Station

Mary is in her final year of high school and is being prepared to perform meaningful work in a nonsheltered vocational environment. Currently, she receives training in clerical skills at a public radio station. This environment was selected for Mary because it is accessible by local public transportation services; there are many opportunities for interactions with nonhandicapped persons; the building itself is wheelchair accessible; and it is in close proximity to community and recreation/leisure environments.

Activity: Stamping Envelopes with First Class Stamps

Skill Sequence

Nonhandicapped Person Inventory	Handicapped Person Inventory (Mary)
1. Get envelopes, ink pad, box and stamps from supply shelf	(+) slow
2. Put supplies on work table and set up (arrange task)	(+) slow
3. Open ink pad	(-) unable to separate lid from base
4. Ink the stamp	(-) unable to press stamp firmly on pad
5. Stamp envelope	(-) very messy
6. Return stamp to ink pad	(+)
7. Put stamped envelope in the box at side of table	(+) slow
8. Repeat steps 4-7 until all envelopes are stamped	
9. Close ink pad	(+)
10. Take box of envelopes to mailroom	(-) required assistance to put box on tray
11. Return ink pad and stamp to supply shelf	(+) slow
Rate: 29 per minute	Rate: 1 per minute

After analyzing the discrepancies in performance between a nonhandicapped person and Mary, the following questions were asked. Which discrepancies in performance might be compensated for by: providing direct instruction on the skills of concern; modifying the skill sequence; and/or providing Mary with an adaptive device and instructing her in its use? For each discrepancy (-), the aforementioned questions were addressed and decisions were made.

Discrepancy #1: Open Ink Pad

Mary was unable to open the ink pad case because of poor fine motor abilities. The ink pad must remain moist, and therefore has to be closed tightly when it is being stored. Therefore, leaving the ink pad open when not being used was not an option.

Decision: No adaptive devices for this discrepancy were generated by her teachers or therapists, but Mary will be expected to participate by asking for specific assistance from a co-worker.

Discrepancy #2: Ink the Stamp

The deficits in fine motor skills interfered with Mary's ability to "ink" the stamp. In particular, she had difficulty grasping the handle of the stamp and applying an even amount of pressure as she inked it.

Decision: The teacher and therapist decided to create two adaptive devices to compensate for this motoric deficit. These are illustrated in Figure 14. First, a small hard rubber ball was placed over the handle of the stamp, thereby changing the size and shape of the handle, enabling Mary to grasp it. This was accomplished by cutting a hole in the ball and then inserting the handle into it. Second, a small platform for the ink pad was constructed. This adaptation reduced the angle at which the stamp would contact the pad. That is, instead of placing the stamp perpendicular to the pad, the pad was tipped toward Mary reducing the angle. This adaptation enabled Mary to firmly press the stamp onto the ink pad.

Discrepancy #3: Stamp Envelope

After the ball had been added to the stamp, and the ink stamp had been angled forward, Mary continued to smear ink on the envelope. Mary's inability to stabilize the envelope was observed to be the reason for smearing. In other words, as she contacted the envelope with the stamp, the envelope moved causing the ink to smear.

Decision: Dycem was put on the work surface to prevent the envelope from slipping. Dycem is a nonslip plastic material which acts as a "sticky" placemat. While it effectively held the

Ball is attached to top of stamp

Ink pad is tilted forward

Figure 14. Two adaptive devices to assist in stamping addresses on envelopes. (Designed by David Jennings)

envelope in place, it also prevented Mary from sliding the envelopes off the table into the box located on the floor next to the table. Therefore, the dycem was removed and Mary was taught to prevent the envelope from slipping by placing her right elbow on it. Mary also used a rubber finger cot on the middle finger of her left hand to assist her to slide the envelopes off the table after they were stamped.

Discrepancy #4: Take Box of Envelopes to Mailroom

In order to complete the activity sequence, Mary must take the box of stamped envelopes to the mailroom. However, she was unable to lean forward in her wheelchair to reach for, grasp and lift the box off the floor.

Decision: No adaptive devices were generated. When the box was full or needed to be taken to the mailroom, Mary was taught to ask a co-worker to put it on her tray.

In general, the adaptive devices which Mary used were designed to compensate for her physical deficits. Her performance discrepancies were the result of physical rather than intellectual handicaps. While she is now able to physically perform the activity because of the adaptive devices, she will continue to receive instruction in this activity to improve her rate and quality of performance.

B. Additional Examples

In this section detailed examples of adaptive devices which were designed to improve the vocational functioning of four severely handicapped students are presented. Each example includes: a description of the student; the domain, environment, and activity for which the device was developed; a nonhandicapped person inventory; a handicapped person inventory; and the resulting modified skill sequence. In some cases, teacher interventions are listed as well. These were included to give the reader a reasonable understanding of the students' current level of functioning. In many of the activities, the individual skills within the sequence could have been further dissected. This would have given a better indication whether the student was having, for example, difficulty initiating the response and/or making a qualitatively appropriate response. Ford et al. (1982) provide an excellent discussion of this issue. However, for purposes here, only a gross delineation of skills is presented. Following the modified skill sequence is a written description of the adaptive device and information regarding its use by the student. The information was presented in this fashion to further emphasize the need for an individualized approach to the development and utilization of adaptive devices.

Example #1: Electric Stapler Jig

Description of Student

Rhonda is a 15-year-old severely multihandicapped student diagnosed as having spastic quadriplegia,

hydrocephaly and epilepsy. She currently resides at a large residential institution. Rhonda is nonambulatory, lacks head and trunk control, and is nonverbal. During activities which require the use of her hands, she uses her right hand. Interfering behaviors which have been identified include rumination, mouthing her right hand, and inappropriate vocalizations.

Domain: Vocational

Environment: American Red Cross

Activity: Stapling a Two Page Collation

Nonhandicapped Person Inventory	Handicapped Person Inventory	Modified Skill Sequence
After arriving at the work room:		
1. Get materials from supply cabinet: Basket for finished work and paper and staples.	(-)	1. Handicapped peer gets materials from supply cabinet.
2. Get daily work from Red Cross employers.	(-)	2. Rhonda is wheeled to Red Cross employees to get daily work.
3. Return to work table.	(-)	3. Rhonda is wheeled to work table.
4. Take one piece.		4. Handicapped peer sits on Rhonda's left side and collates papers. Finished papers are passed to Rhonda.
5. Staple pages together using stapler.	(-)	5. a. Teacher assists Rhonda to place papers on slide tray. b. Brings hand down with a partial physical prompt from teacher to the front edge of slide tray. c. Pushes the collation with her right hand into an electric stapler which has been stabilized in front of slide tray.

Nonhandicapped Person Inventory	Handicapped Person Inventory	Modified Skill Sequence
		d. Teacher and Rhonda remove the paper and place it into the basket.
6. Place finished work into basket. Repeat steps 2-5 until break time.	(-)	
7. Return finished work to Red Cross employee.	(-)	

Description of Adaptive Devices

The electric stapler jig illustrated in Figures 15.1 and 15.2 was built for Rhonda by her community/vocational teacher. The jig cost approximately $4.00 and required five hours to construct. Its use requires a forward pushing motion and a light grasp. The tray automatically springs back to a resting position. The electric stapler was purchased at a local office supply store and cost approximately $40.00.

Information Regarding the Student's Use of the Adaptive Device

Rhonda was taught to place her hand on the slide tray and push until she heard the stapler. Because she could push forward with her arm, this activity capitalized on a skill already in her repertoire. Although hand sucking continues to be noted in other environments, currently there is none during this vocational activity.

Example #2: Tiered Trays for Two-Page Collation

Description of Student

Peter is a 17-year-old severely handicapped student, diagnosed as having spastic quadriplegia, kyphosis, lordosis, reduced range of motion in his arms and legs, and strabismus. He currently is able to grasp wallet sized objects with his right hand and only uses his left hand and arm to stabilize himself. He is nonverbal and uses a communication book.

Domain: Vocational

Environment: American Red Cross

Activity: Collating Two Pages

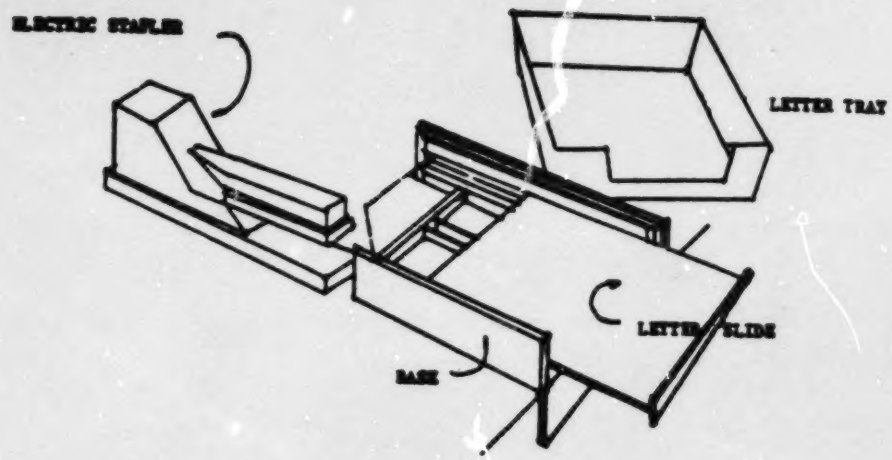


Figure 15.1. Electric stapler jig. (Designed by Alice Udvari)

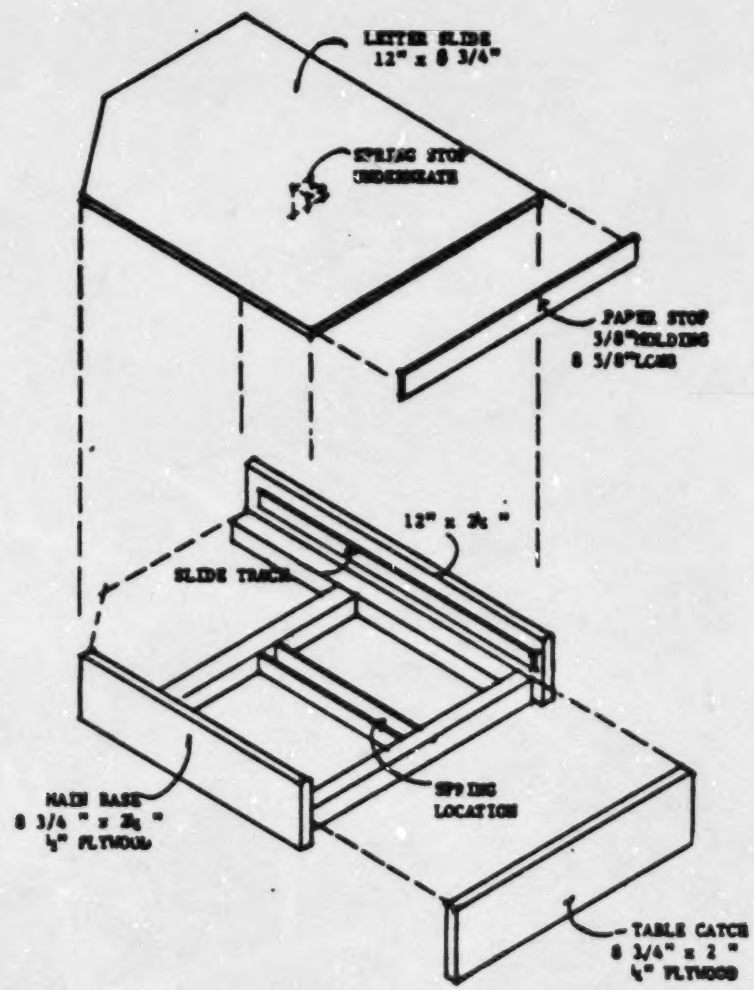


Figure 15.2. Electric stapler jig. (Designed by Alice Udvari)

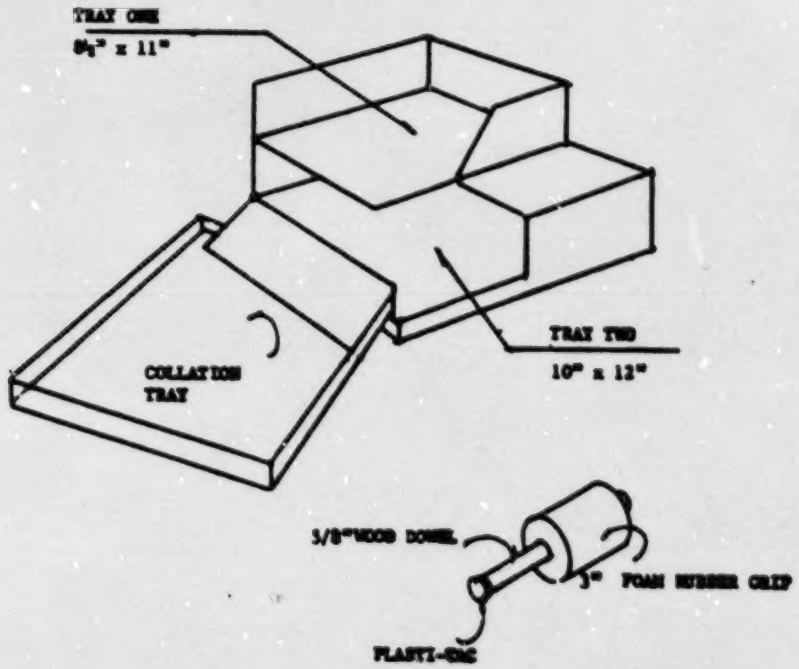
Nonhandicapped Person Inventory	Handicapped Person Inventory	Modified Skill Sequence
1. Get materials and papers from volunteer coordinator.	(-)	1. Handicapped peer gets and sets up materials.
2. Place papers into two piles on table.	(-)	2. Pages are separated into a two level collation jig by teacher or peer.
3. Pick up top paper from first pile, holds in left hand.	(1)	3. a. Pick up built up dowel with "plastitac" on the end. b. Place rubber end of dowel on top sheet of paper on upper level. c. Pull top sheet to the left into collation tray.
4. Pick up top paper from second pile and put evenly on top of first page.	(-)	4. a. Place rubber end of dowel on bottom sheet to b. Pull bottom sheet to the left into collation tray.
5. Staple collation.	(-)	5. Teacher or peer remove the collation for stapling.

Description of Adaptive Device Used

The tiered trays collating jig has two levels which allowed Peter to move one page from the top level and then one from the bottom level. A built up dowel with "plastitac" allowed him to maintain a firm grip and move the pages off each of the two levels without having to handle the paper directly with his hands. A box in which the dowel could be placed was attached to the side of his wheelchair. This device, illustrated in Figure 16, including the built up dowel cost approximately $4.00 and required 3 hours to construct.

Information Regarding the Student's Use of the Device

Peter has only 24 inches of movement from the center of his body and has difficulty crossing midline. Therefore, the collating



NOTE:

TYPICAL CARDBOARD CONSTRUCTION
USED LETTER BOXES, ETC.

Figure 16. Tiered trays for two-page collation. (Designed by Alice Udvari)

jig was placed six inches from his wheelchair on the right side. The teacher continues to provide instruction related to the sequence of steps required to complete this activity.

Example #3: Adaptation to Mark Inventory Tags for Hospital Supply Boxes

Description of Student

Carl is a 20-year-old severely handicapped student. He is diagnosed as having spastic diplegia. He is nonambulatory, nonverbal, and exhibits several interfering behaviors including mouthing, head banging, and inappropriate vocalizations.

Domain: Vocational

Environment: The Central Supply Department of a Hospital

Activity: Marking and Placing Inventory Cards on Hospital Supply Boxes, e.g., Anesthesia Sets

Nonhandicapped Person Inventory	Handicapped Person Inventory	Modified Skill Sequence
1. Get the box of labels from supply area.	(-)	1. Teacher gets boxes of labels.
2. Get the boxes of anesthesia sets.	(-)	2. Teacher gets anesthesia sets.
3. Return to work area.	(-)	3. NA
4. Open case containing 48 anesthesia set boxes.	(+)	4. Open case of 48 anesthesia set boxes and place the box in the box stabilizer.
5. Mark 48 cards with correct code using a felt tip pen by filling in a dot.	(-)	5. a. Take inventory card from card holder. b. Place inventory card in card marking jig. c. Place the felt tip pen down into the plastic tubing and bears down.

Nonhandicapped Person Inventory	Handicapped Person Inventory	Modified Skill Sequence
		d. Pulls pen out and places it in the can on table.
6. Tear off strip of one card then place on anesthesia set box. Do this 48 times.	(+)	6. Tear adhesive strip off one card and then places card on anesthesia set box located in the box stabilizer (continue until 48 boxes are completed).
7. Replace boxes into original case	(+)	7. Replace boxes into original case.
8. Return case to supply area.	(-)	8. Teacher returns boxes to supply area.

Description of Adaptive Device

The adaptive device illustrated in Figure 17 is a board used to stabilize the boxes of anesthesia sets, hold the inventory cards, and allow the inventory cards to be positioned such that Carl can accurately mark the correct circle using the card marking jig. This jig contains plastic tubing to assist in the correct positioning of the felt tip pen. The circle on the card indicates the date of inventory. This device cost approximately $4.00 and required 3 hours to construct.

Information Regarding the Student's Use of the Adaptive Device

The device was designed to compensate for poor fine motor skills and frequent arm movements which interfered with marking the inventory cards. Carl continues to require instruction related to the skill sequence.

Example #4: Sectioned Box With Sliding Lids and Chute Adaptations for Packaging Medicine Into Plastic Bags

Description of Student

Mark is a 20-year-old severely handicapped student. He is ambulatory and nonverbal and requires repeated verbal and physical

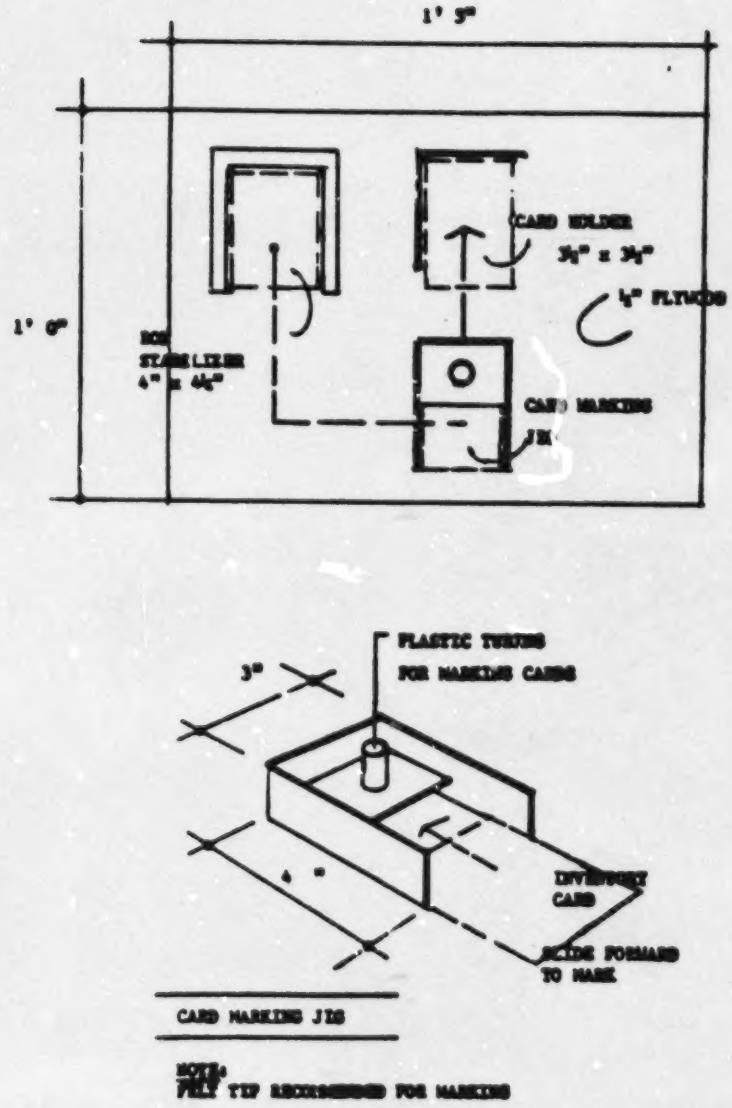


Figure 17. Adaptation to mark inventory tags for hospital supply boxes. (Designed by Alice Udvari)

prompts to work continuously. He has poor fine motor skills and primarily uses a palmar grasp when manipulating objects.

Domain: Vocational

Environment: Hospital Pharmacy

Activity: Packaging Pill Packets

Nonhandicapped Person Inventory	Handicapped Person Inventory	Modified Skill Sequence
1. Get materials. a. 5" x 7" Ziploc bag b. Cases of Potassium Chloride (KCL) pill packets	(-)	1. Get materials with assistance from teacher.
2. Count out 30 packets.	(-)	2. Peer or teacher counts 6 sets of 30 packets.
3. Place the 30 packets into a Ziploc bag.	(-)	3. Teacher sets up materials. Attaches sectional box with sliding lids to side of table with C-clamp.
4. Close bag.	(-)	4. Teacher sets up packaging chute in front of student at the table.
5. Repeat steps 2 through 4, thirty times.	(-)	5. Participate in reaching for the Ziploc bags.
6. Place closed bags on supply shelf.	(-)	6. Participate in attaching Ziploc bags onto clips.
		7. Push lid open on one section of the box.
		8. Grasp handful of packets.
		9. Place packets in the chute.
		10. Repeat steps 8-9 until no packets remain in the section.
		11. Pull bag off clips with right hand.

Nonhandicapped Person Inventory	Handicapped Person Inventory	Modified Skill Sequence
		12. Transfer bag from right to left hand and place in a storage box on the left. 13. Grasp the black knob on the packaging chute with left hand and push laterally until next bag on the inner track moves into position beneath the chute. 14. Open second section of box and proceed as in Steps 8-12. 15. Open third section of box and proceed as in Steps 8-13. 16. Teacher and student set up box for the next set of 30.
Note: On two occasions during the work time, the finished bags are placed on the supply shelf. The correct shelf is marked with an example of the packets to be shelved.		

Description of Adaptive Devices

Two adaptive devices illustrated in Figures 18 and 19 were developed to assist Mark in this packaging sequence. The divided box with sliding lids (Figure 18) clamps onto a table enabling him to package 3 bags, each containing 30 packets in the correct sequence. It is anticipated that Mark will always require some level of intervention to count 30 packets.

The decision to put separate sliding lids on each section of the divided box was made because Mark would reach arbitrarily into any of the 3 sections if they were filled with pills. The lids helped to control which section he reached into and resulted in only 30 packets being packaged at one time.

The chute adaptation (Figure 19) was developed to assist Mark when transferring the packages into the bags. The pills fall through

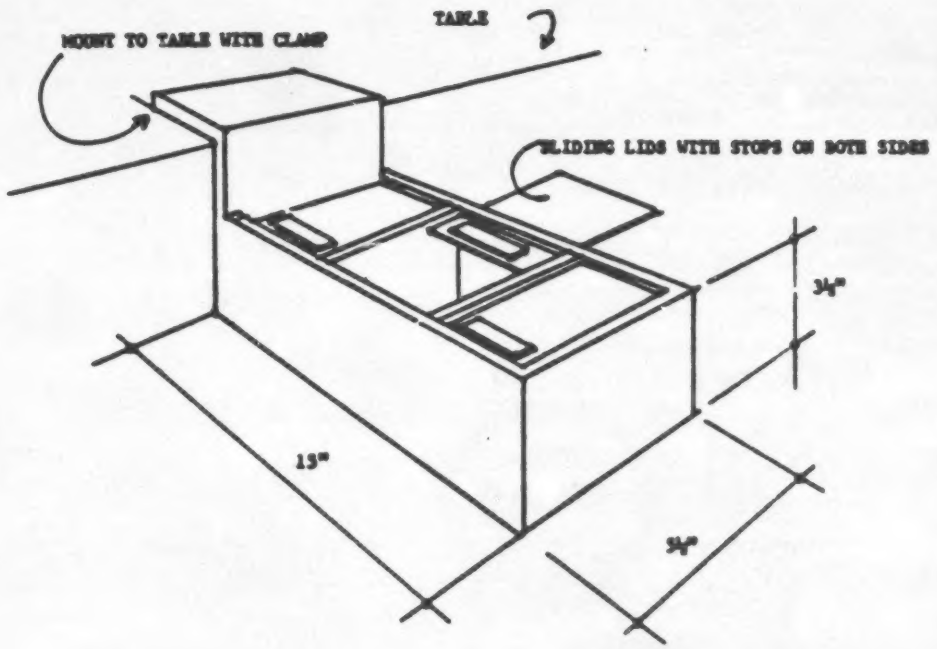
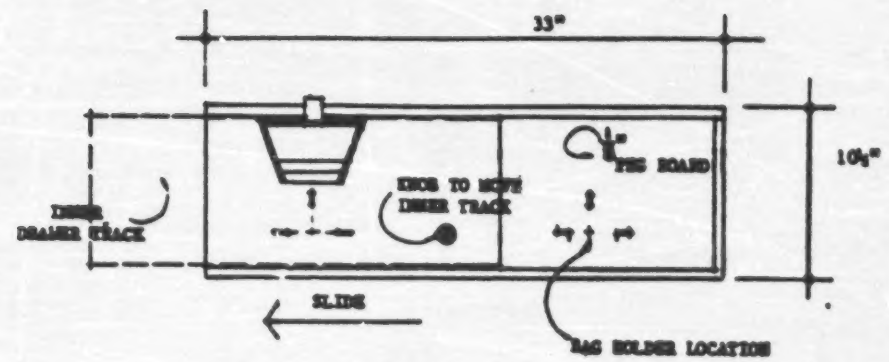
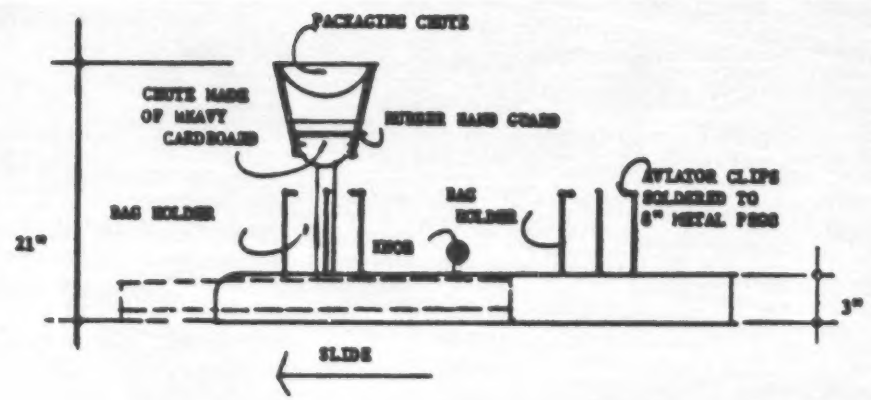


Figure 18. Sectioned box with sliding lids. (Designed by David Jenninga)





MATERIALS

- ¾" HARDWOOD FOR BASE
- 6" METAL PEGS
- 6 AVIATOR CLIPS
- ¼" PEG BOARD
- DRAWER TRACK
- KNOB EASILY GRIPPED IN PALM

Figure 19. Chute adaptation for packaging medicine into plastic bags. (Designed by David Jennings)

the chute into the bag. The bags were initially set up to be filled by Mark and the teacher. After a bag was filled it was removed and then another was moved to the left by pushing the black knob.

These two adaptive devices are relatively complex and required approximately $20.00 and 10 hours to construct. However, this amount of money and construction time was well invested considering that Mark used the device 5 hours per week.

Information Regarding the Student's Use of the Adaptive Device

Mark required ongoing instruction to use both devices. He continues to require verbal and physical prompts in the majority of the steps within the sequence. Mark participated in the majority of steps in the sequence. For example, although requiring assistance, he helped push the black ball which moves the inner track.

V. SUMMARY

When a severely handicapped student cannot perform a particular skill or a sequence of skills within an activity, the following questions might be posed:

1. Has the Individual Education Program been carefully delineated such that the student is acquiring skills necessary for functioning in school and nonschool environments?

2. Could the skill or sequence of concern be taught as it would be to a nonhandicapped person (i.e., without the use of an adaptive device)?

3. Does the student require an adaptive device to perform skills across all domestic, vocational, community and recreation/leisure environments?

4. Has the adaptive device been selected based on the examination of at least 11 dimensions?

5. Does the student require a device because of a physical or an intellectual deficit?

6. How much instruction will be required to teach the student to use the adaptive device?

7. Are there intentions to fade the use of the device over a specified period of time?

Considerations of these questions can help educators to make decisions regarding the selection and development of adaptive devices to be utilized by severely handicapped students which, in turn, should enable them to function more productively and independently in a wider variety of environments and activities.

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